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An international comparison of the contribution to job creation by high-growth firms*

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Abstract

This paper addresses three simple questions: how should the contribution of HGFs to job creation be measured? how much does this contribution vary across countries? to what extent does the cross-country variation depend on variation in the proportion of HGFs in the business population? The first is a methodological question which we answer using a more highly articulated version of the standard job creation and destruction accounts. The other two are empirical questions which we answer using a purpose-built dataset assembled from national firm-level sources and covering nine countries, spanning the ten three year periods from 2000/03 to 2009/12.

The basic principle governing the development of the accounting framework is the choice of appropriate comparators. Firstly, when measuring contributions to job creation, we should focus on just job creating firms, otherwise we are summing over contributions from firms with positive, zero, and negative job creation numbers. Secondly, because we know growth depends in part on size, the 'natural' comparison for HGFs is with job creation by similar-sized firms which simply did not grow as fast as HGFs. However, we also show how the measurement framework can be further extended to include, for example, a consistent measure of the contribution of small job creating firms.

On the empirical side, we find that the HGF share of job creation by large job creating firms varies across countries by a factor of two, from around one third to two thirds. A relatively small proportion of this cross-country variation is accounted for by variations in the influence of HGFs on job creation. On average HGFs generated between three or four times as many jobs as large non-HGF job creating firms, but this ratio is relatively similar across countries. The bulk of the cross-country variation in HGF contribution to job creation is accounted for by the relative abundance (or rarity) of HGFs. Moreover, we also show that the measurement of abundance depends upon the choice of measurement framework: the 'winner' of a cross-national HGF 'beauty contest' on one measure will not necessarily be the winner on another.

Keywords: high-growth firms; firm growth; job creation

JEL codes: D22; E24; L11; L25; L26; M13

1 introduction and a sketch of the argument

1. In the "High-growth enterprise" section of the 2017 edition of the OECD publication *Entrepreneurship at a Glance* there is a paragraph headed "Relevance" which reads,

"High-growth firms are important contributors to job and wealth creation. *A small set of high-growth enterprises drives a disproportionately large amount of employment creation.*"
OECD (2017, p. 90) (emphasis added)

This sentiment, which expresses a widely held belief, has appeared in each annual edition of the publication since it first appeared in 2011. Indeed it was the *disproportionality* between the *small* number of firms and the *large* share of job creation which initially motivated research on high-growth firms (HGFs), and underpins the continuing interest in the subject (for some background see Anyadike-Danes et al. (2012)).

2. Given this rationale for the interest in HGFs, and given that it is the HGF contribution to job growth which continues to attract the interest of policymakers, it is a little surprising to find that relatively little work seems to have been published which actually reports on the HGF contribution to job creation. In particular, no such data are to be found amongst the OECD's own entrepreneurship indicators. The OECD publication typically restricts itself to HGF numbers and measures of HGF incidence – the ratio of HGF numbers to enterprise population numbers (in OECD terms the HGF "rate"). In particular, and notwithstanding the statement quoted above, it *does not* include measures of the importance of HGFs to job creation.¹ Here we address this significant 'gap' in the evidence base.
3. Our ambitions are, in fact, rather more wide-ranging: we wish to provide an account of HGF contribution to job creation which goes beyond a single series of figures. Instead we wish to locate HGFs within the wider population of private sector firms. Because the definition of an HGF involves comparisons over three year 'growth periods', we have had to adapt the framework provided by the conventional job creation and destruction accounts (see Davis et al. (1996)), lengthening the time period over which flows are measured. Instead

¹However it does include statistics on the contribution of HGFs to the *level* of employment.

of annual growth, we look at changes over a series of overlapping three year 'growth periods' (essentially, a moving average measure).² We have also further articulated the accounts to distinguish different sub-populations of firms.

4. So this paper is concerned with both methodology and empirics. The principal methodological contribution is the development of a coherent framework for the measurement of the HGF contribution to job creation by job creating firms. It also derives some 'diagnostic tools' by using a multiplicative decomposition of the job creation measure to write it as the product of three components: the relative size of HGFs; the relative growth of HGFs; and the HGF 'rate' – that is the share of HGFs in the population of job creating firms. And this last, the HGF rate, is a 'natural' measure of HGF importance, suitable for use in cross-country comparisons.
5. The empirical findings, aside from illustrating the implementation of the measurement framework, provide evidence about cross-country variation in the contribution of HGFs to job creation in nine countries over ten 3-year periods between 2000/03 and 2009/12. In brief,
 - in 2009/12 HGFs accounted for between one quarter (Austria) and one half (Finland) of job creation by large job creating firms. Most countries had shares between 30% and 40%, and the country rankings remained quite stable between 2000/03 and 2009/12
 - again focusing just on 2009/12, the principal driver of cross-country differences was the HGF rate with Austria (the lowest rate, at 3.7%) less than a quarter of the UK (the highest rate, at 16.0%, in Finland the rate was 12.5%)
6. The rest of the paper is organised into five sections. We start by laying out a framework with which to measure job creation, and then

²The use of overlapping periods follows the guidelines set out in the *Manual of Business Demography*,

"The identification of high-growth enterprises on an annual basis may lead to the inclusion of an enterprise in the population of high-growth enterprises in several years. The question arises whether a high-growth enterprise ... should be counted in more than one reference year if it fulfills the given definition. The recommendation is to do so." EUROSTAT-OECD (2007, p.63)

use it to formulate an intuitively plausible ‘answer’ to the disproportionality question. We then work backwards, decomposing the share of HGFs in job creation, to develop a measure of the HGF rate. In the course of this analysis we also devise a new metric – an ‘index of disproportionality’ – which can be used to summarise the HGF contribution to job creation. Finally, we also illustrate how an alternative (but possibly more conventional) answer to the measurement of the HGF contribution yields a rather different picture of cross-country HGF ‘rankings’. A short Appendix describes data sources.

2 the question of measurement

2.1 previous work

7. As mentioned earlier, surprisingly little effort seems to have been devoted to measuring the contribution of HGFs to job creation. Indeed, confining ourselves to studies which rely on *The Manual of Business Demography* (‘OECD’) definition of HGFs, the only published work seems to be three papers by Albert Bravo-Biosca (and collaborators). These papers had their origins in a joint project by FORA (the division for research and analysis of the Danish enterprise and construction authority) and NESTA (a UK-based thinktank) in collaboration with researchers and national statistical agencies, and with support from the International Consortium for Entrepreneurship (ICE) and the Entrepreneurship Indicators Programme (EIP). This project aimed to produce an internationally harmonised database of firm-level data on (mainly) firm growth.³
8. Although the disproportionality between the HGF share of firms and the HGF share of job creation is mentioned in all three papers (see Bravo-Biosca (2011, pp. 18-22), Bravo-Biosca et al. (2016, pp. 719-720) and Bravo-Biosca (2016a, p. 18)), the discussion of HGF job creation was not the principal concern of any of them. In each case the discussion refers to a single three year growth period, 2002/2005⁴ with data for 12 countries – Austria, Canada, Denmark, Finland, Italy,

³For a brief history of the EIP see, <http://www.oecd.org/std/business-stats/theentrepreneurshipindicatorsprogrammeeipbackgroundinformation.htm>

⁴There is though a very extensive data appendix associated with Bravo-Biosca (2011) published some years later which reports data for 2004/07 or 2005/08 for half the countries (see Bravo-Biosca (2016b)).

the Netherlands, New Zealand, Norway, Spain, the United Kingdom and the United States. The disproportionality finding is reported at greatest length in Bravo-Biosca (2011),

“High-growth firms represent between 3 and 6 per cent of all surviving firm with ten or more employees.... But they make a disproportionate contribution to job creation, accounting for between a third and a half of all jobs created by surviving firms with ten or more employees. There are however differences across countries in the contribution of high-growth firms to employment creation ... For instance, Finland and Denmark had a similar share of high-growth firms, but they respectively accounted for 48 per cent vs. 37 per cent of job creation by surviving firms with ten or more employees.” Bravo-Biosca (2011, p. 19)

However, this finding is not discussed any further.

9. The FORA-NESTA project clearly made a noteworthy contribution to the study of HGF job creation, most particularly by building a database on common definitions allowing a meaningful comparison across a large sample of countries. Indeed, we will compare our findings to those reported in Bravo-Biosca (2016b) for the six countries which appear in both. Here, though, we move beyond their treatment in two important respects. Firstly, we develop a measurement framework which allows us to dig a little below the surface of disproportionality; secondly we have data on ten 3-year periods, so we can investigate change over time.

2.2 the accounting framework & the choice of denominator

10. There are two simple principles underpinning the design of our measurement system: one is dictated by international convention – the OECD definition of an HGF.⁵ The other is a matter of arithmetic con-

⁵In 2014 EUROSTAT changed the growth criterion used to define HGFs from 20% per year over three years, to 10% per year over three years. Although there does not seem to be any published rationale for this change, the Statistics Directorate of the OECD confirmed that the HGF threshold was lowered to suit the data requirements of an innovation indicator (OECD (2018)). EUROSTAT still collects data on the 20% criterion, but Member States supply it on a voluntary basis. The OECD publishes data on both definitions, see OECD (2017, pp. 90-93).

sistency: it is desirable when measuring the contribution of a component, here HGF job creation, to a total, that the aggregate in the denominator is a sum over positive numbers, so we need to use gross job creation, not net job creation (that is gross job creation less job destruction).⁶ Bearing these two principles in mind, our bespoke accounting framework is an hierarchically organised set of classifications. At the very top of the hierarchy are counts of all firms alive at the beginning of, and all those alive at the end of, a *growth period*. Since (following conventional practice) we use a 3-year growth period we are comparing populations of firms at year t and at year $(t + 3)$.

11. The first step is to divide firms alive in year t (all_t) into two categories: those which are alive at the beginning of *both* year t and year $(t + 3)$, these firms are the survivors ($surv_{t,t+3}$) (sometimes referred to as ‘continuing’ firms); and the dead ($dead_{t,t+3}$), those firms which do not survive to year $(t + 3)$,

$$all_t \equiv surv_{t,t+3} + dead_{t,t+3}$$

The firms alive at the end of the growth period $(t + 3)$ (all_{t+3}), also comprise two categories. First, we have the survivors from year t . Second, there are firms which are alive at the beginning of year $(t + 3)$ but were not alive at t . This second group of $t + 3$ survivors are firms which have been born *within* the three year period and survived to $(t + 3)$, and these firms, born in years $(t + 1)$, $(t + 2)$ and $(t + 3)$, taken together are referred to as ‘new’ firms ($new_{t+1,t+3}$).

$$all_{t+3} \equiv surv_{t,t+3} + new_{t+1,t+3} \equiv surv_{t,t+3} + \sum_{s=1}^3 new_{t+s,t+3}$$

12. We distinguish two further levels in our hierarchical classification,⁷ but these apply only to the survivors.

- survivors are divided into two size-bands (with size measured at time t): *small*, less than 10 jobs; and *large*, 10 or more jobs. This

⁶It is important to be clear, though, that gross job creation here is the sum over firm-level net job creation by job creating firms.

⁷We considered the possibility of an age distinction – young versus old – but for many countries this extra level would result in some very small counts which might be suppressed by the statistical authorities to preserve confidentiality.

usage of the labels small and large is not conventional, however it is designed to match the size boundary used to separate HGFs from non-HGFs (in the official HGF definition, see EUROSTAT-OECD (2007)). It is worth noting though that internationally recognised classifications (for example, EUROSTAT) often refer to firms with less than 10 employees as "micro-enterprises".

- we then further divide each of the two categories of survivors (small and large) into three: *job creating firms*, which have more jobs at $t + 3$ than they had at t ; *job destroying firms*, which have less jobs at $t + 3$ than they had at t ; and *non-job creating firms*, which have exactly the same number of jobs at both t and $t + 3$.

13. Altogether then we have six categories of survivors. One of these six is of particular interest – the large job creating firms – since it is within this category that high-growth firms (HGFs) are to be found. According to the official OECD definition (see EUROSTAT-OECD (2007, Chapter 8)) HGFs are job creating firms with 10 or more jobs at time t (so 'large' in our terminology) which record an average 20% annual growth rate over the period t to $(t + 3)$.⁸ It seems natural, therefore, to measure HGFs contribution to job creation with reference to job creation by large job creating firms. This population serves to standardise HGF numbers and enables meaningful comparisons to be made, in this case across countries.
14. Whilst it is easy to see why HGFs should be compared with other job creating firms (but not with those that create no jobs, or even destroy them): does the choice of a denominator within the class of job creating firms matter? Whilst it may not matter much when comparing HGFs over time in a single country, it can be important, as we shall see, when comparing HGFs across countries. For example, the relative importance of large *versus* small represents an independent dimension of difference across countries. To ignore such dimensions, as we shall see, runs the risk of conflating cross-country differences in the size distribution of firms with the cross-country differences in performance which the HGF indicator was designed to highlight.

⁸Strictly speaking, the OECD definition also requires that an HGF be at least one year old at a time t , but we have dropped that requirement here.

3 the HGF contribution to job creation

3.1 the hgf share

15. The left hand panel of Figure 1, labeled ‘share’, displays the share of HGFs in job creation by surviving large job creating firms. The series have been plotted on a log scale to make the comparison of relative rates of variation across countries easier to see (on a log scale differences in slopes are interpretable as differences in relative rates of change) .
16. In summary, HGFs account for between one quarter (Austria) and a half (Finland, Germany and the UK) of all job created by large job creating firms. Three features of the data are worth highlighting,
- *there appears to be a trend decline.* In all countries the shares in 2009/12 are smaller than they were in 2000/03, albeit in many cases the decrease is quite slight. Germany and the UK record a relatively steep drop, but amongst the rest only Sweden recorded a double digit decrease. Of course, with 2009/12 as our last growth period, it is possible that at least some of this decline might be reversed as economies recover from the Great Recession.
 - *the cross-country range has narrowed over time.* In 2000/03 it was about 30 percentage points, by 2009/12 it had shrunk to 20 percentage points. The reduction in the overall range is accounted for by changes at the top end of the distribution – the decline in shares for Germany and the UK – because at the bottom end the HGF share for Austria remained broadly unchanged.
 - *the rankings are quite stable.* Not only do the top and bottom of the country rankings stay the same, most of the other ranks do too. A ‘consensus ranking’ over the 10 periods confirms this result, the only uncertainty is which of Denmark or New Zealand, should be sixth and which seventh).⁹

17. However, in order to assess the *relative* importance of HGFs to job creation – the extent to which they are ‘special’ – we need a metric

⁹The algorithm used to produce the ‘consensus rankings’ is described in Edmond and Mason (2002), and implemented in the R package ConsRank, see D’Ambrosio and Amodio (2015).

which compares their job creation performance with that of large job creating firms more generally. We can define an *index of disproportionality (idisp)*, which expresses HGF job creation *per HGF* as a ratio to large job creating firm job creation *per large job creating firm*. More formally,

$$idisp^{hgf} \equiv \left(\frac{hgf_{t+3}^j - hgf_t^j}{hgf^f} \right) \div \left(\frac{survla_{t+3}^j - survla_t^j}{survla^f} \right) \quad (1)$$

where hgf and $survla$ refer to HGFs and surviving large job creating firms respectively, and the j and f superscripts denote jobs and firms. This index is plotted in the right hand panel of Figure 1, again on a logarithmic scale. And, to assist comparability, we have used the same log point range on the right hand panel as on the left hand panel and with equal (log) tick marks.¹⁰

18. We can see immediately that for most countries, most of the time, the disproportionality index falls within quite a narrow range, between three and four. In other words, HGFs create 3 or 4 times more jobs than the HGF share in the large job creating firm population. There is only one very clear outlier, the index for Austria averages close to six. Remember this is a country which recorded the lowest HGF contribution to job creation, so the index finding suggests that HGFs are relatively rare in Austria (that is, there are relatively few HGFs which created a hugely disproportionate share of jobs). Equally, the UK index is right at the bottom of the plot with a parallel interpretation: given a relatively large share in job creation the index suggests HGFs are relatively abundant in the UK. By contrast Finland and Sweden are close to the top of *both* the share and index plots.
19. We can safely conclude that HGFs, as measured here, are certainly a group of firms which *in every country* contribute disproportionately to job creation by producing three or four times more jobs than large firms in general.

3.2 comparison with Bravo-Biosca (2011)

20. As was mentioned earlier, work by Bravo-Biosca (and collaborators) seem to provide the only published estimates of the HGF share of job

¹⁰So for example the proportionate difference between 33% and 55% in the share is equivalent to the proportionate difference between 4.5 and 7.4 in the index.

creation. The right hand panel of Figure 8 in Bravo-Biosca (2011, p. 19) displays data on the "Share of job creation by high-growth firms – 10+ employees" for 11 countries (plus the European average) for the 2002/2005 growth period. Helpfully, this barplot has the data recorded on each bar.¹¹ Of the 11 countries on the plot, our data covers about half: Austria; Denmark; Finland; New Zealand; Norway; and the United Kingdom. Bravo-Biosca (2011) also has data on: Canada; Italy; Netherlands; Spain; and the United States; but not for: Belgium; Germany and Sweden; which appear in our sample of countries.

21. Table 1 panel (a) displays our data on the HGF share of job creation by large job creating firms and that from Bravo-Biosca (2011, Figure 8, p. 19) for the six 'common' countries for the common 2002/05 growth period. Evidently the two series are of the same order of magnitude, with the UK and Austria at the top and bottom of the rankings respectively (and the R^2 of a linear fit between them of 0.8). However, there are also some notable differences. In particular our New Zealand figure is 41.9%, whilst his is ten percentage points lower at 31.9%. Whilst we are, in principle, both using the same measure (HGF job creation in the numerator, jobs created 10+ job creating firms in the denominator), there is at least one difference in the implementation of the measures. In the 'variable definitions' section of Bravo-Biosca (2016b) we find,

"Share of jobs created high-growth firms: Number of jobs gained by high-growth firms in that category as a share of the total number of jobs gained by surviving firms in that category with positive job creation (*specifically, above 1% per annum*) over the period." Bravo-Biosca (2016b, p. 24) (italics added)

We have not imposed the italicised condition – "specifically, above 1% per annum", all we require is that a firm have more jobs at the end of the growth period than at the beginning, and it is impossible to know *a priori* what difference such a restriction might make. Equally, as noted above we have departed from the OECD definition by including in the HGF total firms born in the first year of the growth period (year t) with 10 or more employees and which pass

¹¹This data were subsequently reproduced in Bravo-Biosca (2016b, Table N.7, p. 250).

the 20% per annum growth threshold.¹²

22. Quite possibly more important are the details of underlying databases and their compilation. Like Bravo-Biosca (2016b) we provide a description of sources: for ours see the Appendix; for Bravo-Biosca see Bravo-Biosca (2016b, p. 25). Whilst in some cases at least, for example the UK, the sources do appear to be identical, this is not the case for all countries (for example, New Zealand). Moreover, the compilation of aggregate statistics from hundreds of thousand (sometimes millions) of firm-level records are dependent of the details of the code used and the date at which it is run.

3.3 a wider job creation denominator and the contribution of new firms

23. We have compared the job creation of HGFs to that of their putative ‘parent’ population since our principal concern is the distinctive character of HGFs *compared to other large job creating firms*. However, it is nonetheless worth putting HGF job creation performance in a wider context. Still considering only job creating firms, we now include surviving small job creating firms and jobs in new firms – the jobs at $(t + 3)$ in firms born *during* the growth period. The shares of this ‘wide’ job creation denominator contributed by all the four categories of job creators is displayed, country by country, on Figure 2.
24. The HGF share of this wider job creation denominator is necessarily much smaller (typically about one third the size recorded in Figure 1), however our interest here is to see how the other categories of job creating firms fit into the picture. It is evident from Figure 2 that, in almost every country, and almost all the time, the share of new firms is considerably larger, and fluctuates considerably more widely, than that of any of the other three categories. The new firm share is typically 40% to 50%. Looked at on this scale the HGF share seems not to play a very significant role. Indeed it is difficult to distinguish the HGF share from that of small firms, both are typically in the 10% to 20% range. By contrast the large (non-HGF) contribution exceeds

¹²Also Bravo-Biosca (2016b) covers a slightly different collection of sectors: NACE Rev1.1 10–74, whilst ours is NACE Rev 1.1 15 – 74, and 90 – 93.

both the HGF and small firm shares, except in Germany¹³ and in Austria (where it is close to the new firm share).

25. Since new firms evidently play such a large role in the evolution of job creation (confirming a finding in the literature which discusses the relative importance of age and size in accounting for job creation, see for example Haltiwanger et al. (2013)) it is worth digging a little deeper. After all, the interest in HGFs is inspired by disproportionality, not the relative size of their contribution *per se*. We cannot, however, simply compare the index for (say) new firms with the HGF index displayed in Figure 1: since we have a new, wider, denominator, including small and new firms, the index must be re-computed.
26. Figure 3 sets out the indices for each of the four categories of job creators (we have reported only country-level averages since the time series are not relevant here). Notice first of all that the value for HGFs is (on average) about 14 (although the values for the UK, at around 20, is much higher), so about three times larger than the measure which appeared in Figure 1.¹⁴ So, compared to *all* job creating firms, HGFs contribute 14 times their share in the job creating firm population.
27. By contrast new firms are at the other end of the job creating scale, the index is typically between 0.8 and 0.9 (though Germany and the UK are lower). Although, as we saw earlier, new firms do indeed contribute a large share of jobs created this may be attributed to the sheer numbers of new firms which enter at some stage during a three year period, and are still alive at its end. The index takes on an intermediate value of about 2.5 for (non-HGF) large firms; whilst for small firms the index averages 0.6, lower than for new firms.
28. Evidently, if policy interest is driven by disproportionality rather than by the scale of the contribution to job creation, then larger, established, firms are worthy of more attention than smaller or newer ones. But the key conclusion concerns HGFs: although they may contribute a relatively modest proportion of the jobs created by *all*

¹³Germany has a quite distinctive, and different, pattern. The new share declines quite steeply after 2002/05, matched by a rise in the large share. Indeed in 2008/11 the two shares 'cross over', with the large share 10 percentage points above the new share in 2009/12.

¹⁴Remember the average share is roughly one third of the large job creating firm measure which was associated with an index of disproportionality of about four.

job creating firms – averaged over all countries and all periods about 15% – this contribution is importantly *disproportionate*, it is about 14 times the HGF share of the job creating firm population.

4 from the HGF share to ‘the’ HGF rate

29. Our preferred measure of HGF importance, based on the share of job creation by large job creating firms, can in fact be decomposed in a way which allows us to better identify the proximate sources of difference between countries.

30. We can define the growth of HGF jobs ($ghgf^j$) as,

$$ghgf^j \equiv \frac{\Delta hgf^j}{hgf_t^j}$$

and the growth of surviving large job creators ($gsurvla_j^j$) can be defined analogously. We can then write the HGF share of large firm job creation as,

$$\frac{\Delta hgf^j}{\Delta survla_j^j} \equiv \frac{ghgf^j \times hgf_t^j}{gsurvla_j^j \times survla_t^j}$$

then, following some manipulation, we can write the following expression,

$$\frac{\Delta hgf^j}{\Delta survla_j^j} \equiv \frac{ghgf^j}{gsurvla_j^j} \times \frac{\frac{hgf_t^j}{hgf_t^f}}{\frac{survla_t^j}{survla_t^f}} \times \frac{hgf_t^f}{survla_t^f} \quad (2)$$

31. So the the share of HGFs in job creation is the product of three terms:¹⁵

- the ratio of HGF growth to job growth in all large surviving job creating firms – *relative growth* ($\frac{ghgf^j}{gsurvla_j^j}$)

¹⁵Comparing the definition of the index of disproportionality from equation (1) with the result in equation (2) you will appreciate that we could re-write equation (6) as,

$$\frac{\Delta hgf^j}{\Delta survla_j^j} \equiv idisp^{hgf} \times \frac{hgf_t^f}{survla_t^f}$$

- the ratio of the average size of HGFs to the average size of all large surviving job creating firms – *relative size* ($\frac{\frac{hgf_t^j}{hgf_t^f}}{\frac{survla_{jt}^j}{survla_{jt}^f}}$)
- the ratio of the number of HGFs to the number of all large surviving job creating firms – *the HGF rate* ($\frac{hgf_t^f}{survla_{jt}^f}$)

The last of these three, as we shall see, is the most interesting, because it is a measure of HGF ‘rarity’.

4.1 the three components of the HGF share

32. The three components are displayed side by side on Figure 4. The series have been plotted in logs with a common log range (2.5 log points) and the tick marks in each panel are equally spaced (0.5 log points apart), so that we can readily compare relative variation across panels even though the components have rather different magnitudes.
33. For most countries, the HGF relative growth rate (on the left hand panel) is typically around five times the growth of large job creating firms, and this relative growth rate is quite similar across countries (there is just one quite striking outlier: Belgium where HGF growth is typically eight times that of the large job creators). As with relative growth, the size ratio for most countries (displayed in the middle panel) falls within a very narrow band: in this case between 0.5 and 0.75. So HGFs on average are typically considerably smaller than the population of large job creating firms.¹⁶
34. Finally, the right hand panel displays the third component – the HGF rate. Clearly, the distribution of this ratio is less compact than the other two components. There are two countries which stand out at the top of the chart: the UK and Germany. If we leave aside the first two periods (when the UK rate was particularly affected by the ‘high tech’ boom of the early 2000s), we can see that the UK is only marginally above Germany, and that their ratios are around five percentage points above the next country. At the very bottom is Austria,

¹⁶In this case too there is just one outlier. At the top Austria is the only country with HGFs larger than average large job creating firms (in fact on average 25% larger).

about 3 percentage points below Belgium, the country immediately above it, which is in turn a few percentage points below the rest. The other countries form a quite tightly bunched group. Indeed, and this is another striking feature of the plot, the ratios for group in the middle become rather more similar and by 2009/12 all five countries are within three percentage point range. Neither Austria nor Belgium show any tendency to join this group from below, however the declining ratios in the UK and Germany bring them quite close to the countries in the middle of the distribution by 2009/12.

35. It is quite striking that the three outliers here – the UK and Germany at the top, and Austria at the bottom – are exactly those we saw earlier in the left hand panel of Figure 1: the HGF share of job creation plot. Not only are they the same (although the rankings of the UK and Germany are reversed here), but also they exhibit similar trends: a declining HGF rate. For Austria it is broadly flat. Moreover, if we look more closely, we can see that the pattern of rankings in the other countries fairly stable, and roughly match the rankings in the HGF job creation share plot.
36. Even though we know from equation (2) that the HGF share and the HGF rate are linked, country-period by country-period, by an identity we can use a simple statistical short-cut to summarise the average relationship between them. If we fit a line to the scatter of the log of country average shares against the log of the country rates, the fitted line accounts for 92% of the variance in the share. This is simply telling us that the variation in the relative growth and relative size components (when averaged over time) is quite small. The slope coefficient is close to 0.6, implying that an HGF rate which is 10% larger will be associated with an HGF share of job creation which is 6% larger.

4.2 comparison the HGF rate in Bravo-Biosca (2011)

37. Earlier we looked at the HGF share reported in Bravo-Biosca (2011), the same source also reports data on the HGF 'rate' for the same set of countries. In this case, though, the comparison is rather less straightforward because Bravo-Biosca (2011) uses a different measure. Necessarily the numerator of the rate is the same – a count of HGFs – but the denominator is not. Our denominator 'matches' the numerator: the count of surviving large job creating firms; Bravo-Biosca (2011)

uses a much wider denominator: he includes *all* surviving large job creating firms. In other words it includes surviving large firms which do not create jobs, as well as those which destroy jobs. However, the rationale for including firms other than those which create jobs is not explained.¹⁷

38. Although the measure reported by Bravo-Biosca (2011) does not match ours, we can provide a comparable estimate from our data – by adding the number of firms which do not create jobs and those which destroy jobs to our preferred denominator – and it is recorded in panel (b) of Table 1. As with the ‘shares’ recorded in panel (a), the two rates measures in panel (b) are broadly similar (the R^2 of a linear fit is 0.8). The figure for Finland matches almost exactly (as it does in panel (a)), whilst Austria, for example, is different by one percentage point.

5 from one HGF rate to another

39. The HGF rate which has emerged from the decomposition of the HGF share clearly fits with our ‘demographic’ perspective – large job creating firms are the population at risk of becoming HGFs – so it fits quite naturally with the objective of investigating the contribution of HGFs to job creation. From the last term in equation (2) we can write the formal definition of this rate ($hgf r^n$) as,¹⁸

$$hgf r^n \equiv \frac{hgf}{survla_j} \quad (3)$$

We can also write down an HGF rate with an alternative denominator, the wider denominator used as an alternative measure of shares in job creation (in section 3.2 above): it includes all job creating firms – large, small and new.¹⁹ And we can derive a simple expression

¹⁷However, as we shall see in the next section, OECD/Eurostat suggest an even wider denominator.

¹⁸All the variables in the equations in this section refer to firms, so the f superscript has been omitted.

¹⁹The denominator suggested by OECD/Eurostat is a variant of this: it includes all firms with more than 10 jobs which are alive at the end of the growth period (see EUROSTAT-OECD (2007, p.63)). In other words it includes not just all large survivors (as does Bravo-Biosca (2011)) but it also includes large new firms too. No rationale is provided for this choice of denominator.

linking the wider HGF ratio ($hgfr^w$) to our preferred, 'narrow', measure ($hgfr^n$),

$$hgfr^w \equiv \frac{hgf}{survla_j + survsm_j + new} \quad (4)$$

$$\equiv \frac{survla_j}{survla_j + survsm_j + new} \times hgfr^n \quad (5)$$

The two rates are plotted on Figure 5, with the 'narrow' rate in the left hand panel (reproduced from the 'rate' panel of Figure 4), and the 'wide' ratio in the right hand panel. The two series have been plotted on log scales where the log range (2.5 log points) is the same in both, and the tick marks (0.5 log points) are equally spaced in both too.

40. We discussed the features of the narrow rate plot earlier, here we are interested principally in the narrow/wide comparison. The ratios are different in size by about a factor of 5 (4 to 20 *versus* 1 to 5). But it is not the difference in scale which is most striking: the 'picture' does not look same. In particular, and most immediately noticeable, the rankings of some countries are very different. For the narrow rate Germany and the UK share the top ranking, and Austria is at the bottom of the plot, by quite a distance. By contrast, on the wide rate plot, Norway is at the top almost throughout, whilst the UK, from the top, and Austria (from the bottom) have moved into the main group, leaving Belgium typically at the bottom. Equally striking are the contrasting trends in the German data: the narrow rate is steadily declining whilst the wide rate rises almost throughout.
41. How do we account for the differences between the two pictures of the HGF rate? The proximate cause of the differences between the German rates turns out to be a steeply rising share of large firms in the population of job creating firms. As we know from equation (3) this share is the 'multiplier' which turns the narrow rate into the wide. The large firm shares are plotted on Figure 6 and we can see immediately that the German share rises by almost three quarters, from 10% to 17%. Austria's large firm share stands out too: it is broadly constant, but about 60% larger than in any other country, sufficiently large to move Austria from the bottom of the narrow ratio rankings, into the middle of the rankings on the wide ratio. Equally, the large firm share for Norway (high), and the UK (low),

shows up in the contrasting narrow and wide ratios and the pattern of change in the large firm share.

6 summing up

42. This paper has addressed three simple questions: how should the contribution of HGFs to job creation be measured? how much does this contribution vary across countries? to what extent does the cross-country variation depend on variation in the proportion of HGFs in the business population? The first is a methodological question which we answer using a more highly articulated version of the standard job creation and destruction accounts. The other two, empirical, questions we answer using a purpose-built dataset assembled from national firm-level sources and covering nine countries, spanning the ten three year periods from 2000/03 to 2009/12.
43. The basic principle governing the development of the accounting framework is the recognition of a need for appropriate comparators. Firstly, when measuring contributions to job creation, we should focus on job creating firms, otherwise we are summing over firms with positive, zero, and negative job creation numbers. Secondly, because we know growth depends in part on size, the 'natural' comparison for HGFs is with job creation by similar-sized firms which simply did not grow as fast as HGFs. We also show how the measurement framework can be further extended to include, for example, a consistent measure of the contribution of small job creating firms.
44. On the empirical side we find that the HGF share of job creation by large job creating firms varies across countries by a factor of two, from around one third to two thirds (with the exact figure depending on the time period). A relatively small proportion of this cross-country variation is accounted for by variations in the disproportionate influence of HGFs on job creation. Although on average HGFs generated between three or four times as many jobs as large non-HGF job creating firms, this ratio is relatively similar in most countries. The bulk of the cross-country variation in shares is, in fact, accounted for by the relative abundance (or rarity) of HGFs, measured by the HGF rate, which does differ quite widely across countries. For example, in 2009/12 the HGF rate in the UK was roughly four times the rate in Austria, though for most countries though the rate was

towards the middle of the range and around 10%. Evidently the relative abundance of HGFs plays a key role in driving cross-country variations in the importance of HGFs in job creation.

45. We have also compared our findings with those of Bravo-Biosca (2011), the only other published estimates of the contribution of HGFs to job creation. The scope for comparison is necessarily limited because Bravo-Biosca (2011) provides data for just one of the ten growth periods we consider. Our datasets have six countries in common and the HGF shares for those six, though differing in detail, are broadly consistent. Our study therefore confirms the disproportionate role in job creation which his study had documented (see Bravo-Biosca (2011, p. 19)), and shows that this disproportionality is indeed a persistent feature of job creation performance for over a decade in nine countries.
46. These are our key findings. However we also explored some variant definitions. Perhaps unsurprisingly, for the 'widest' definition of job creating firms (including small firms and start-ups) HGFs are even more disproportionately significant: on average HGFs created 14 times as many jobs as the average job creating firm. Equally unsurprisingly, having widened the job creating category, the associated HGF rate is rather lower, the 'wide' rate is about one sixth the size of our preferred measure. What might not have been anticipated, though, is that the ranking of countries on this 'wide' rate is quite different. Most notably, Austria, which was at the bottom on our preferred measure, and the UK which was at the top, are both in the middle of the 'wide' rate distribution. This difference is largely attributable to differences in proportions of micro-enterprises in the population of firms. The implication of this finding is quite clear: *denominators are important*. This conclusion is of particular significance for interpreting the results of 'beauty contest' type comparisons which seek to account for cross-country variation in the HGF rate using cross-country differences in, for example, institutional arrangements and/or the 'flexibility' of labour markets.²⁰ It seems reasonable to propose that, at the very least, such findings should be tested with alternative measures of the HGF rate indicator.

²⁰For a recent example see Bravo-Biosca et al. (2016).

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7 Appendix: data sources and construction

As mentioned earlier, the data here has been produced by “distributed micro-data analysis”, using local experts to build in local knowledge of data sources, definitions and disclosure policies but guided here by the measurement framework and definitions set out in the **Manual of Business Demography** EUROSTAT-OECD (2007).

The simplest way to proceed is to summarise the key dimensions of our ‘benchmark’ dataset and then list, in Table 1, the ways in which national datasets depart from it. The ‘standard’ is,

1. definition of a firm – an employer enterprise, that is a business with at least one employee
2. definition of employee – a person who receives a wage or salary from a firm
3. enumeration of employees – head count with no distinction between full-time and part-time employees
4. firm birth date – first employee joins
5. firm death date – last employee leaves
6. sectoral coverage – the ‘private’ or ‘business’ sector (NACE rev1.1: 15 to 74; 90 to 93)
7. enumeration of firms – all employer enterprises in the private sector

As may be inferred from this list, the choice of definitions is designed to be implemented using the administrative databases of a kind compiled by either, or both of, the tax authorities and the social security system. The strength of such databases is typically their universal coverage which follows from their role in administering the revenue and welfare systems. A common weakness, though, is that it is not always possible to distinguish between a *de novo* birth and firms which are ‘born’ following the break-up of an existing enterprise (or the parallel distinction between death and the sale of a firm), so we have not tried to make that distinction here. Equally, we make no allowance for the effects of merger and acquisition activity more generally on the counts of firms and jobs.

There is one important matter of measurement where we have not been able to harmonise the data entirely, the counting of jobs. In Austria, Denmark, Germany, Norway, and the UK, we have a head count measure of

jobs; in Finland the data is for "full time equivalents" (FTE); whilst in Sweden we count persons (each person has a single "main job").²¹ Whilst these differences are obviously important, it is not clear that they will significantly affect the answer to our key question about the contribution of HGFs to job creation in an individual country, although they may very well contribute to cross-country differences.

²¹This may also affect Sweden's firm count: firms in which every employee's main job is elsewhere would not be included.

Data sources and departures from 'benchmark'

Sources	
Austria	Administrative data, Social Security
Belgium	Administrative employment data, National Social Security Office
Denmark	General Enterprise Statistics, Statistics Denmark
Finland	Statistics Finland
Germany	Mannheimer Unternehmenspanel (Mannheim Enterprise Panel)
New Zealand	Longitudinal Business Database (Statistics New Zealand)
Norway	Statistics Norway
Sweden	Statistics Sweden
UK	Business Structure Database, Office of National Statistics
Benchmark Departures	
Austria	NACE 1 to 74
Belgium	none
Denmark	none
Finland	employees: full-time equivalent employees; full-time equivalent jobs
Germany	birth: "foundation"; death: "closure"; NACE 10 to 93
New Zealand	firm: more than three employees plus conditions on revenue (details on request); employees: average headcount over the previous 12 months
Norway	none
Sweden	employees: count of persons
UK	none

Notes:

1. data for countries except Germany (see note 2 below) are compiled from official statistics or administrative data. Detailed information on the sources and construction of the data will be provided by the authors on request.
2. data for Germany compiled from the Mannheimer Unternehmenspanel (MUP) dataset which currently covers nearly seven million firms, three million of which are active, with a further circa 0.7 million being categorized as insolvent and three million voluntarily closed. The data are provided biannually by the leading German credit rating agency – Creditreform. Creditreform collects information on legally independent, active firms derived from the German official register of firms, the German insolvency register, company reports, newspapers, and firm interviews. MUP has information on: identity of owners, ownership structure, location, industry classification, number of employees, sales, legal status, firm age and pathways to market exit. The panel structure of the MUP enables observing enterprises over the 1999-2012 period.

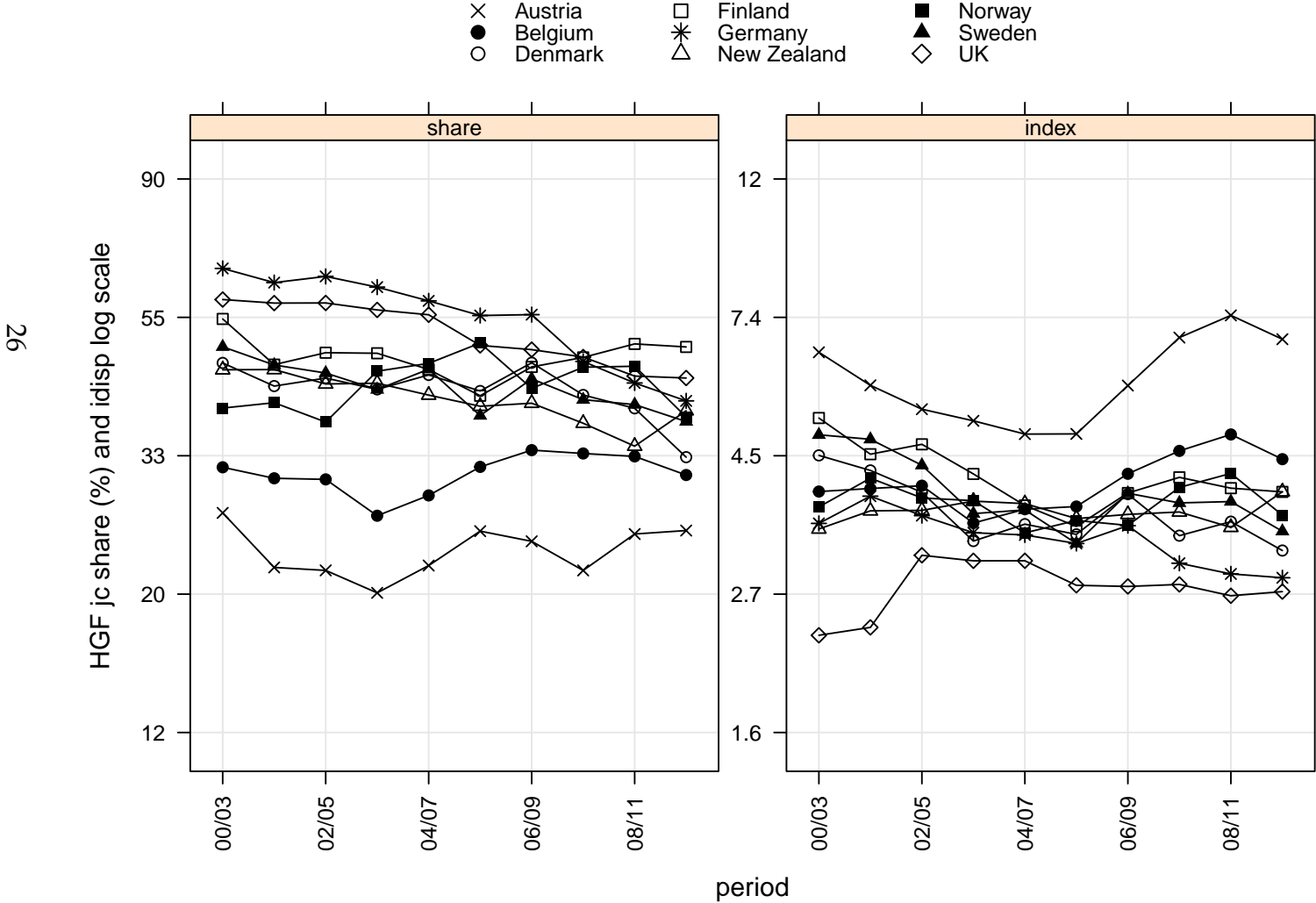
Table 1: comparisons of our data with Bravo-Biosca (2011) for 2002/05

	IHS	B-B
(a) HGF share of job creation (%)		
Austria	21.8	25.5
Denmark	43.8	37.1
Finland	48.1	48.2
New Zealand	41.9	31.9
Norway	37.4	40.4
UK	57.5	63.8
b) HGF 'rate' (%)		
Austria	2.3	3.3
Denmark	4.9	4.0
Finland	4.5	4.4
New Zealand	6.2	6.0
Norway	3.9	3.2
UK	6.7	6.4

Notes:

1. IHS, International HGF dataset (this study); B-B, Bravo-Biosca (2011, Figure 8, p.19)
2. for the definitions of the HGF share and the HGF 'rate', see text
3. the HGF 'rate' recorded in the first column of panel (b) is *not* our preferred definition, see discussion in text

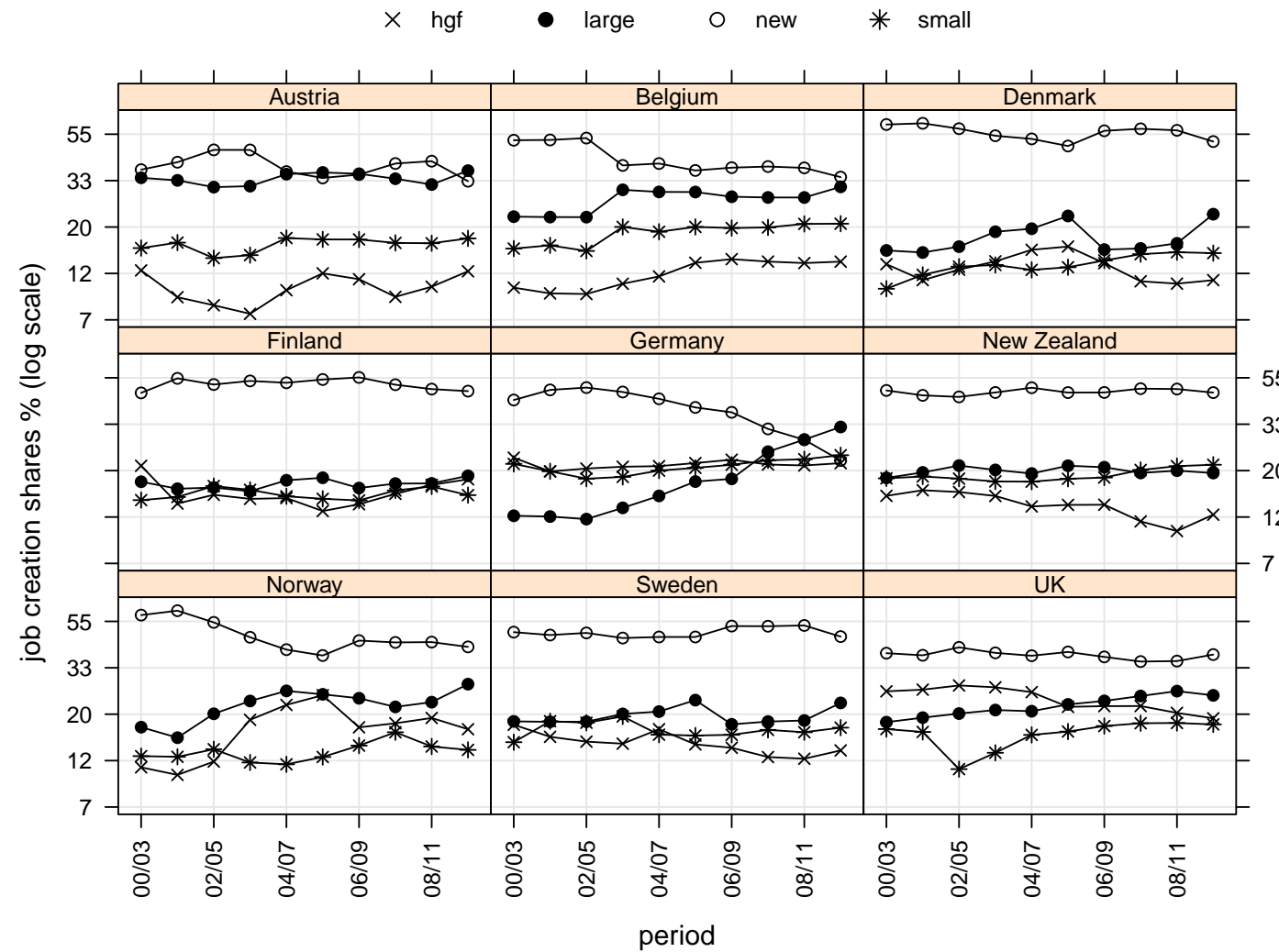
Figure 1: HGF shares of job creation ('share', %) and index of disproportionality ('index') (log scale), 2000/03 to 2009/12



Notes:

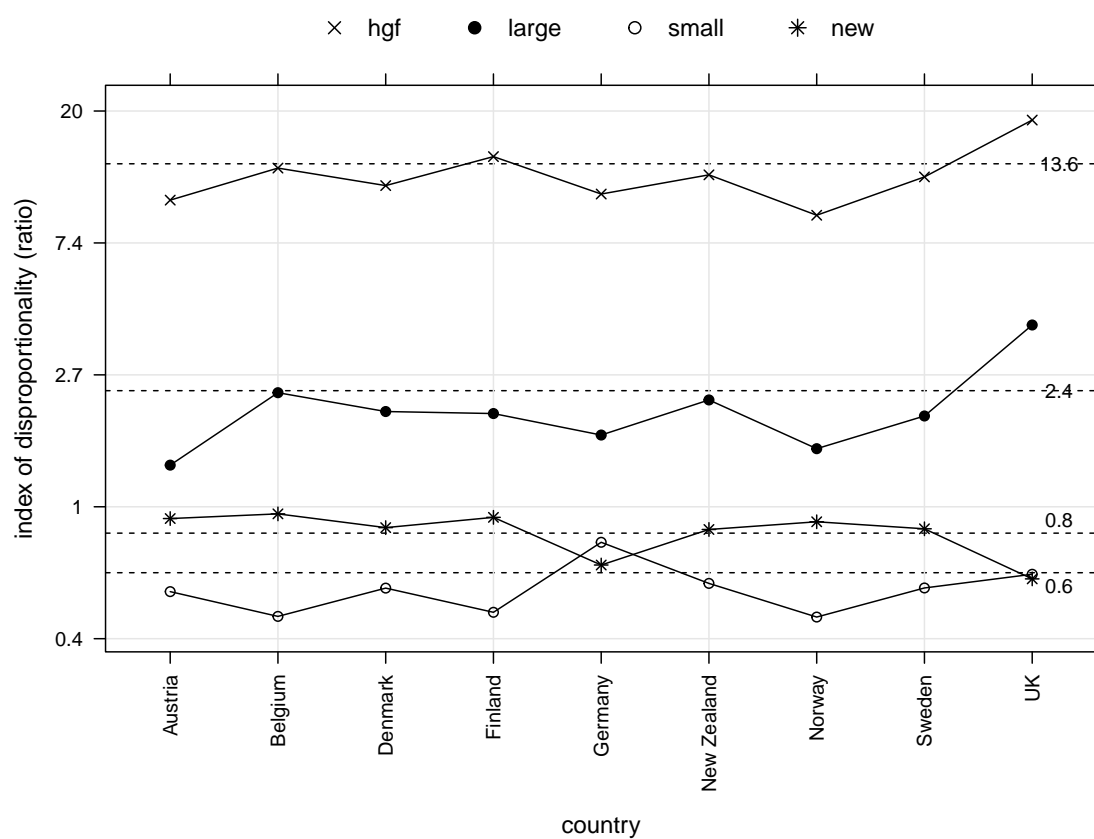
1. 'share', is the share of HGFs in job creation by large job creating firms
2. 'index', is the index of disproportionality, for definition see text section 3.1

Figure 2: shares of job creation by category of job creating firm (%)
(log scale), 2000/03 to 2009/12



Note: for definitions see section 3.3

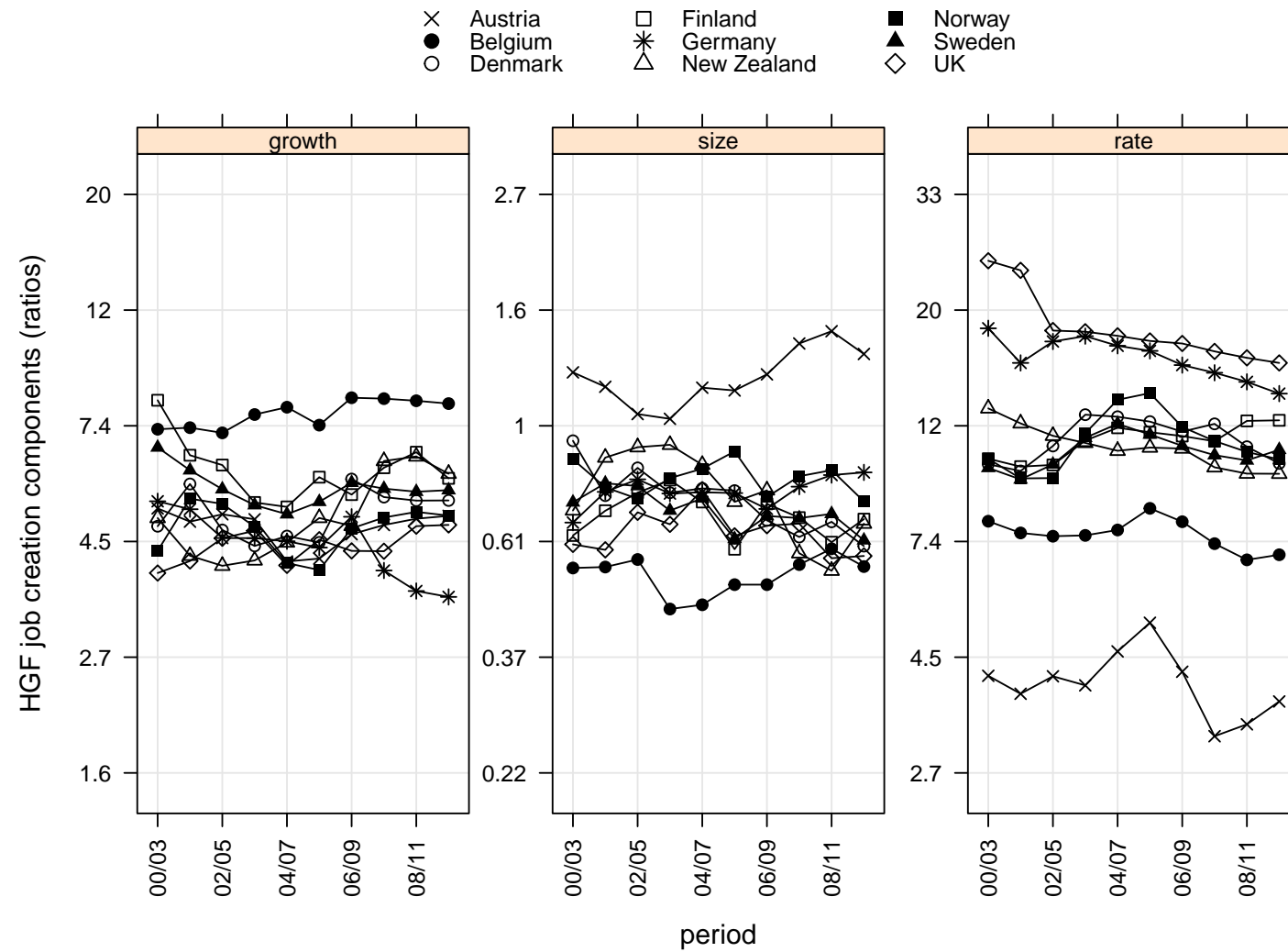
Figure 3: index of disproportionality, all job creating firms, by firm category (log scale), average 2000/03 to 2009/12



Notes:

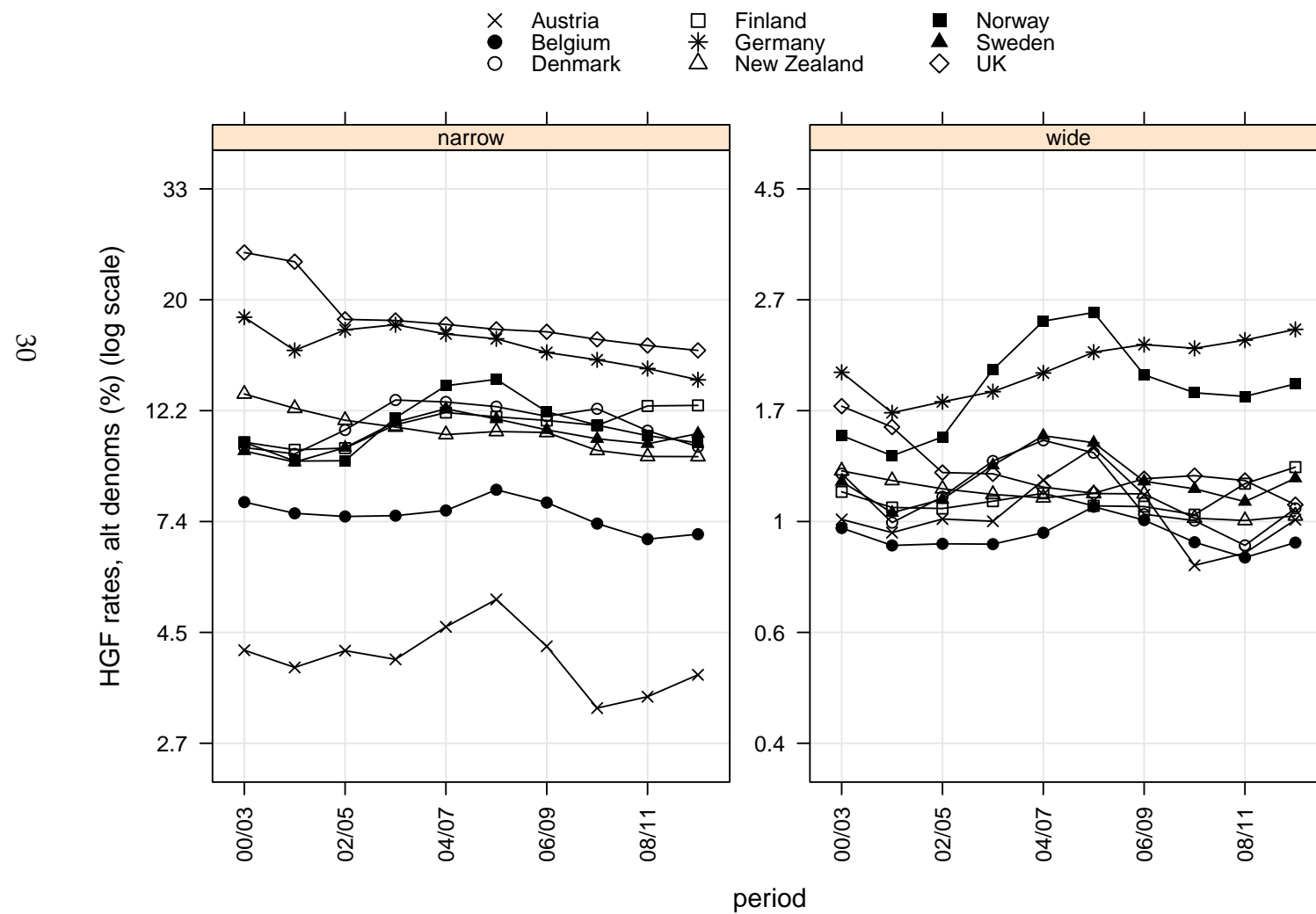
1. for definitions see section 3.3
2. the numbers at the side of the plot are the means of the categories.

Figure 4: HGF share in job creation by component
(log scale), 2000/03 to 2009/12



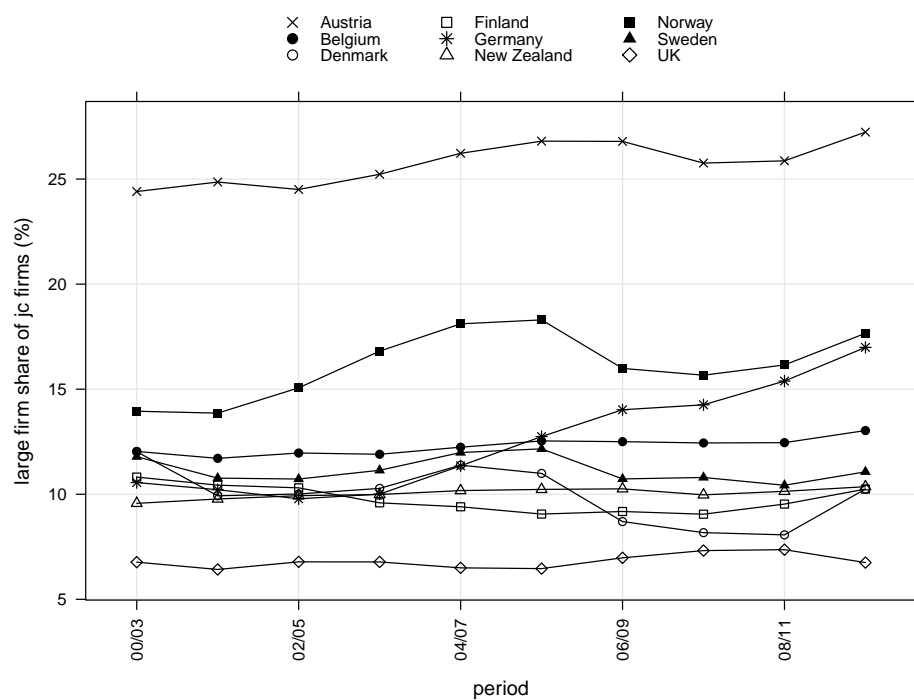
Note: for definitions see section 4

Figure 5: HGF rates, alternative denominators (%)
(log scale), 2000/03 to 2009/12



Note: for definitions see section 5

Figure 6: Large firm share of job creating firms (%)
2000/03 to 2009/12



Note: for definitions see section 5